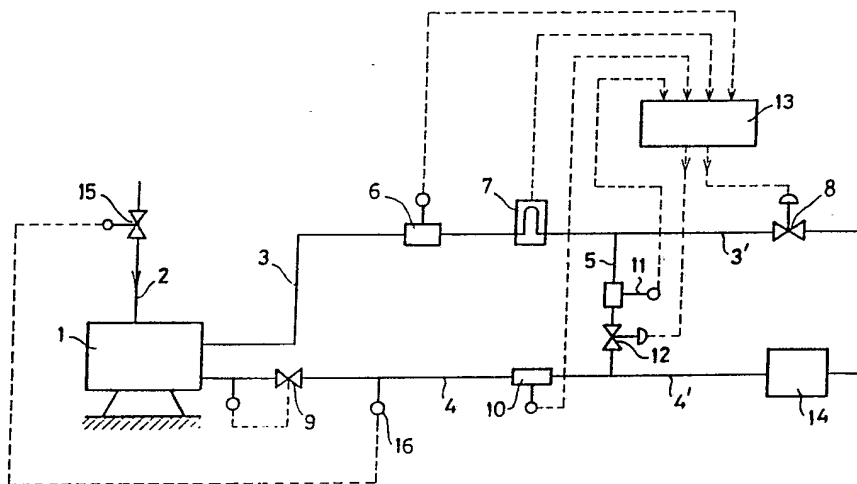




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(21) International Application Number: PCT/NL89/00059 (22) International Filing Date: 20 July 1989 (20.07.89) (30) Priority data: 8801848 21 July 1988 (21.07.88) NL (71) Applicant (for all designated States except US): STORK AMSTERDAM B.V. [NL/NL]; Ketelstraat 2, NL-1021 JX Amsterdam (NL). (72) Inventors; and (75) Inventors/Applicants (for US only) : VAN HOEK, Johannes, Wilhelmus [NL/NL]; 2e Atjehstraat 58, NL-1094 LK Amsterdam (NL). VAN SCHAGEN, Hans, Walter [NL/NL]; Regentesselaan 33a, NL-1405 EJ Bussum (NL). (74) Agent: BARENDREGT, F.; Exterpatent B.V., P.O. Box 90649, NL-2509 LP The Hague (NL).		(81) Designated States: AT (European patent), BE (European patent), CH (European patent), DE (European patent), FR (European patent), GB (European patent), IT (European patent), JP, LU (European patent), NL (European patent), SE (European patent), US. Published <i>With international search report. Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments. In English translation (filed in Dutch).</i>

(54) Title: PROCESS AND DEVICE FOR THE PRODUCTION OF MILK WITH A PREDETERMINED FAT CONTENT

**(57) Abstract**

Described is a process for the production of milk and cream with a predetermined fat content, in which raw milk is separated by a centrifuge into a high-fat fraction (cream) and a low-fat fraction (skimmed milk), in which the fat content in the high-fat fraction is determined and the fat content in the low-fat fraction is kept at a negligibly low level, the volume flow of the low-fat fraction is determined, and a specific part of the high-fat fraction is then added to the low-fat fraction for obtaining milk of the desired fat content (standardized milk), and the remaining part of the high-fat fraction (cream) is drained off through a control valve (8), which is characterized in that the part of the high-fat fraction added to the low-fat fraction is regulated by means of a control valve (12) which in conjunction with the control valve (8) for discharge of the remaining part of the high-fat fraction is controlled on the basis of the volume flow (10) of the low-fat fraction, on the basis of the volume flow (11) of the part of the high-fat fraction added to the low-fat fraction, and on the basis of the density measurement (7) of the high-fat fraction, in such a way that the density of the high-fat fraction - and thus the fat content - is maintained at a set volume. Also is described a device for carrying out the process according to the invention.

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Short title: Process and device for the production of milk with a predetermined fat content.

The present invention relates to a process for the production of milk and cream with a predetermined fat content, in which raw milk is separated by a centrifuge into a high-fat fraction (cream) and a low-fat fraction (skimmed milk), in which the fat content in the high-fat fraction is determined and the fat content in the low-fat fraction is kept at a negligibly low level, the volume flow of the low-fat fraction is determined, and a specific part of the high-fat fraction is then added to the low-fat fraction for obtaining milk of the desired fat content (standardized milk), and the remaining part of the high-fat fraction (cream) is discharged through a control valve.

Such a process is known from Dutch Patent 180715.

In this known process the fat content of both the high-fat fraction and the low-fat fraction is maintained at a desired value by means of separate control circuits having valves controlled by the density or by the pressure, and the part of the high-fat fraction added to the low-fat fraction is regulated by means of the control valve for discharge of the remaining part of the high-fat fraction, said control valve being controlled on the basis of values of the volume flow of the low-fat fraction and of the volume flow of the part of the high-fat fraction added to the low-fat fraction. This known process has the disadvantage that the adjustment of the control valve produces pressure variations in the pipe sections of the high-fat fraction. These pressure variations can affect the working range and the setting of the centrifuge. When there is a change in pressure

the centrifuge therefore has to find a new working point, which takes some time, so that the control process is consequently slow.

In addition, the control range is limited because,
5 in order to be able to add a part of the high-fat fraction to the low-fat fraction, a certain pressure difference has to be present between the high-fat fraction and the low-fat fraction. In the known process this pressure difference depends partly on the position
10 of the control valve, and there is a risk that the pressure in the high-fat fraction will become too low for it to be possible to add an adequate quantity of the high-fat fraction to the low-fat fraction.

The object of the present invention is to produce a
15 process for the production of milk and cream with a predetermined fat content, in which a quicker control than in the known process is possible.

This object is achieved according to the invention in that the part of the high-fat fraction added to the
20 low-fat fraction is regulated by means of a control valve which in conjunction with the control valve for discharge of the remaining part of the high-fat fraction is controlled on the basis of the volume flow of the low-fat fraction, on the basis of the volume flow of the
25 part of the high-fat fraction added to the low-fat fraction, and on the basis of the density measurement of the high-fat fraction, in such a way that the density of the high-fat fraction - and thus the fat content - is maintained at a set value.

30 By means of these two control valves the ratio between the quantity of cream to be added to the low-fat fraction and the quantity of cream to be discharged can be set without the pressure in the high-fat fraction thereby being affected. The pressure in the high-fat
35 fraction is controlled by the two valves on the basis of

the density measurement, which again indicates a measure of the fat content. Since the pressure in the high-fat fraction is thus held constant, the centrifuge remains in the same working point.

5 In an advantageous embodiment of the process according to the invention the volume flow of the high-fat fraction is measured and the control valves are controlled partly on the basis of this measured value. A change in the volume flow of the high-fat fraction is in
10 fact accompanied by a change in the fat content of that fraction. Since the densimeter reacts with some time lag to a change in the fat content, this change is already anticipated by the change detected in the volume flow. This means that the position of the control valves can
15 be adjusted more rapidly to the changing situation.

 If the standardized milk is conveyed to a homogenizer, it is advantageous according to the invention for the raw milk to be conveyed to the centrifuge via a control valve which is controlled in
20 such a way that the pressure in the low-fat fraction remains constant. With the use of a homogenizer it is a requirement that the volume flow to the homogenizer should be constant. The pressure in the low-fat fraction is thus stabilized using this regulable valve.

25 The invention is also embodied in a device for the application of the process, comprising a centrifuge with a supply pipe for the raw milk and a discharge pipe for the high-fat fraction and a discharge pipe for the low-fat fraction, a connecting pipe which connects the
30 discharge pipe for the high-fat fraction to the discharge pipe for the low-fat fraction, a densimeter in the pipe for the high-fat fraction in the region between the centrifuge and the connecting pipe, and a control valve in the discharge pipe for the high-fat fraction,
35 disposed downstream of the connection of the connecting

pipe, viewed in the direction of flow, a volume flow meter in the connecting pipe, and a volume flow meter in the discharge pipe for the low-fat fraction in the region between the centrifuge and the connection of the connecting pipe, said device being characterized in that the connecting pipe is provided with a control valve which together with the control valve in the discharge pipe of the high-fat fraction is connected to a control element which controls the two control valves on the basis of the measured value of the two volume flow meters and of the densimeter in the pipe for the high-fat fraction, in such a way that the density, and thus the fat content, in the high-fat fraction remains constant.

In a preferred embodiment of the invention a volume flow meter which emits a signal to the control element is provided in the discharge pipe for the high-fat fraction.

The invention is explained in greater detail with reference to the drawing, which shows an example of an embodiment of the device according to the invention in a single figure.

In the figure reference number 1 indicates a centrifuge, to which a supply pipe 2 for raw milk and a discharge pipe 3 for the high-fat fraction (cream) and a discharge pipe 4 for the low-fat fraction are connected. The discharge pipes 3 and 4 are connected to each other by means of a connecting pipe 5, which divides each of the discharge pipes 3 and 4 into two sections 3, 3' and 4, 4'.

A volume flow meter 6 and a densimeter 7 are incorporated in the discharge pipe 3 between the centrifuge 1 and the connection of the connecting pipe 5, while a control valve 8 is disposed downstream of the connecting pipe 5.

A pressure-controlled valve 9 for setting the working point of the centrifuge and a volume flow meter 10 are disposed in the discharge pipe 4 for the low-fat fraction between the centrifuge and the connection of the connecting pipe.

Finally, a volume flow meter 11 and a control valve 12 are provided in the connecting pipe 5.

The device is provided with a control element 13 which controls the two control valves 8 and 12 on the basis of measured values coming from the volume flow meters 10 and 11 and from the densimeter 7. The two control valves thus have a dual purpose. On the one hand, they regulate the amount of cream conveyed through the connecting pipe 5 to the low-fat fraction and, on the other, these two control valves keep the fat content in the cream constant by means of the densimeter 7.

A change in the fat content in the high-fat fraction will generally be reflected in a change in the volume flow of the high-fat fraction. Such a change will be detected by the densimeter 7 with some time lag. In order to be able to make the control element 13 react more quickly to such a change, provision is made for the volume flow meter 6, which emits a signal to the control element, so that when the fat content is changed the control element can react more quickly to it.

It will be clear that the volume flow meters 6 and 10 and 11 can also be provided in a different way in the pipes, in such a way that the volume flow can be derived or calculated in each of the pipes or pipe sections.

If the standardized milk is fed to a homogenizer 14 disposed in the pipe section 4' before being discharged, it is necessary to keep the volume flow in the pipe section 4' constant. For this purpose, provision is made in the raw milk supply pipe connected to the centrifuge for a control valve 15 which is controlled by means of a

pressure recorder 16 disposed in the pipe 4, in order to keep the pressure in this pipe at a constant value.

By means of the device described above it is thus possible to produce both cream and standardized milk
5 with predetermined fat percentages. Since the control is designed in such a way that the action of the centrifuge is not thereby affected, a very rapid control is possible, with a sufficiently high pressure difference between the high-fat fraction and the low-fat fraction
10 being maintained for it to be possible always to add an adequate required quantity of cream via the pipe 5 to the low-fat fraction so that the device has a wide control range.

CLAIMS

1. Process for the production of milk and cream with a predetermined fat content, in which raw milk is separated by a centrifuge into a high-fat fraction (cream) and a low-fat fraction (skimmed milk), in which the fat content in the
5 high-fat fraction is determined and the fat content in the low-fat fraction is kept at a negligibly low level, the volume flow of the low-fat fraction is determined, and a specific part of the high-fat fraction is then added to the low-fat fraction for obtaining milk of the desired fat content (standardized
10 milk), and the remaining part of the high-fat fraction (cream) is drained off through a control valve (8),
characterized in that the part of the high-fat fraction added to the low-fat fraction is regulated by means of a control valve (12) which in conjunction with the control valve (8) for
15 discharge of the remaining part of the high-fat fraction is controlled on the basis of the volume flow (10) of the low-fat fraction, on the basis of the volume flow (11) of the part of the high-fat fraction added to the low-fat fraction, and on the basis of the density measurement (7) of the high-fat fraction,
20 in such a way that the density of the high-fat fraction - and thus the fat content - is maintained at a set value.

2. Process according to Claim 1, **characterized in that** the volume flow (6) of the high-fat fraction is measured and the control valves (8,12) are partly controlled on the basis of
25 this measured value.

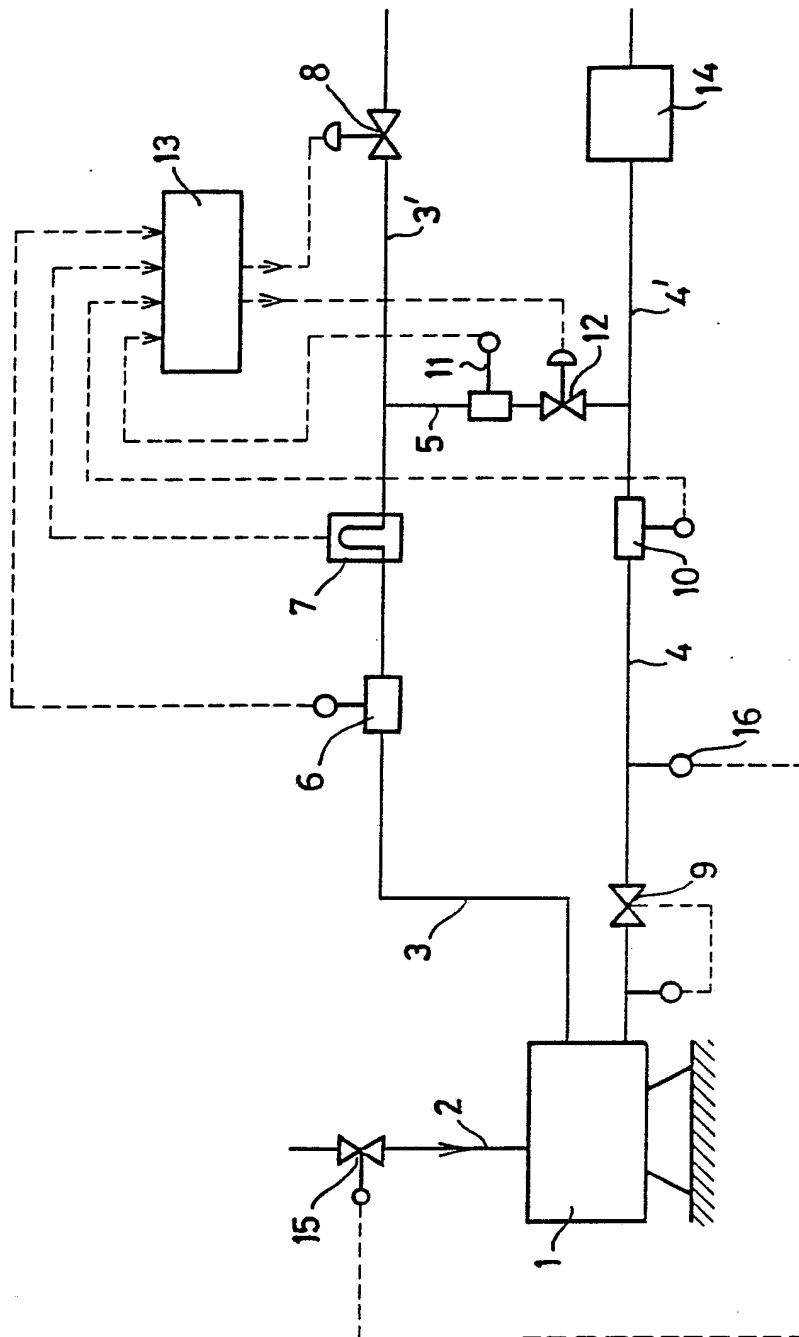
3. Process according to Claim 1 or 2, in which the standardized milk is conveyed to a homogenizer (14),
characterized in that the raw milk is fed to the centrifuge (1) via a control valve (15) which is controlled in such a way that
30 the pressure in the low-fat fraction remains constant.

4. Device for the application of the process according to one of the preceding claims, comprising a centrifuge (1) with a supply pipe (2) for the raw milk and a discharge pipe (3) for

the high-fat fraction and a discharge pipe (4) for the low-fat fraction, a connecting pipe (5) which connects the discharge pipe (3) for the high-fat fraction to the discharge pipe (4) for the low-fat fraction, a densimeter (7) in the pipe (3) for the high-fat fraction in the region between the centrifuge (1) and the connecting pipe (5) and a control valve (8) in the discharge pipe (3) for the high-fat fraction, disposed downstream of the connection of the connecting pipe (5), viewed in the direction of flow, a volume flow meter (11) in the connecting pipe (5), and a volume flow meter (10) in the discharge pipe (4) for the low-fat fraction in the region between the centrifuge (1) and the connection of the connecting pipe (5), characterized in that the connecting pipe (5) is provided with a control valve (12) which together with the control valve (8) in the discharge pipe (3) of the high-fat fraction is connected to a control element (13) which controls the two control valves (8,12) on the basis of the measured value of the two volume flow meters (6,10) and of the densimeter (7) in the pipe (3) for the high-fat fraction, in such a way that the density and thus the fat content in the high-fat fraction remains constant.

5. Device according to Claim 4, characterized in that a volume flow meter (6) which emits a signal to the control element (13) is provided in the discharge pipe (3) for the high-fat fraction.

6. Device according to Claim 4 or 5, in which the standardized milk is conveyed to a homogenizer (14), characterized in that a control valve (15) is accommodated in the supply pipe (2) for raw milk to the centrifuge (1), said control valve (15) being controlled by means of the pressure in the discharge pipe (4) for the low-fat fraction in order to keep this pressure constant.



INTERNATIONAL SEARCH REPORT

International Application No. PCT/NL 89/00059

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) ⁶		
According to International Patent Classification (IPC) or to both National Classification and IPC		
IPC ⁵ : A 23 C 9/15, A 01 J 11/10		
II. FIELDS SEARCHED		
Minimum Documentation Searched ⁷		
Classification System	Classification Symbols	
IPC ⁵	A 23 C, A 01 J	
Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched ⁸		
III. DOCUMENTS CONSIDERED TO BE RELEVANT ⁹		
Category ^a	Citation of Document, ¹¹ with indication, where appropriate, of the relevant passages ¹²	Relevant to Claim No. ¹³
Y	Deutsche Molkerei-Zeitung DMZ, vol. 108, no. 30, 23 July 1987, (Münich, DE) F. Hellström: "Die richtige Standardisierungstechnik verbessert die Wirtschaftlichkeit", pages 966-970, see page 966, column 2, page 967, column 2- page 968, column 1; figure 1 --	1,2,4,5
Y	Voedingsmiddelentechnologie, vol. 8, no. 35, 27 August 1975 "Apparatuur voor automatische continu-standaardisatie van het vetgehalte in melk", pages 11-13, see page 12, column 1; figures 1,2; page 13, column 2 --	1,2,4,5
A	DE, A, 2628225 (MASCHINENFABRIK STROMAG) 5 January 1978, see claims 5,8,12-14; pages 38-40, 44-45; figures 3,10 --	1,4
<div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <p>^a Special categories of cited documents: ¹⁰</p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> </div> <div style="width: 45%;"> <p>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step</p> <p>"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.</p> <p>"&" document member of the same patent family</p> </div> </div>		
IV. CERTIFICATION		
Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report	
23rd October 1989	27.11.89	
International Searching Authority	Signature of Authorized Officer	
EUROPEAN PATENT OFFICE	T.K. WILLIS	

III. DOCUMENTS CONSIDERED TO BE RELEVANT (CONTINUED FROM THE SECOND SHEET)		
Category *	Citation of Document, with indication, where appropriate, of the relevant passages	Relevant to Claim No
A	FR, A, 2231318 (ALFA-LAVAL) 27 December 1974, see claims 1,2; figures; page 2, line 36 - page 4, line 3 -----	1,4

**ANNEX TO THE INTERNATIONAL SEARCH REPORT
ON INTERNATIONAL PATENT APPLICATION NO.**

NL 8900059
SA 30131

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report. The members are as contained in the European Patent Office EDP file on 17/11/89
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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
DE-A- 2628225	05-01-78	None	
FR-A- 2231318	27-12-74	SE-B- 374989	07-04-75
		AU-B- 465534	02-10-75
		AU-A- 6898874	02-10-75
		CA-A- 1010534	17-05-77
		DE-A, C 2421018	19-12-74
		GB-A- 1423110	28-01-76
		JP-A- 50018661	27-02-75
		NL-A- 7407130	03-12-74
		SE-A- 7307559	02-12-74
		US-A- 3983257	28-09-76

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DOCUMENT-IDENTIFIER: WO 9000862 A1
TITLE: PROCESS AND DEVICE FOR THE
PRODUCTION OF MILK WITH A
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PUBN-DATE: February 8, 1990

INVENTOR-INFORMATION:

NAME	COUNTRY
VAN, HOEK JOHANNES WILHELMUS	NL
VAN, SCHAGEN HANS WALTER	NL

ASSIGNEE-INFORMATION:

NAME	COUNTRY
STORK AMSTERDAM	NL

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EUR-CL (EPC): A01J011/10 , A23C009/15

US-CL-CURRENT: 99/456

ABSTRACT:

Described is a process for the production of milk and cream with a predetermined fat content, in which raw milk is separated by a centrifuge into a high-fat fraction (cream) and a low-fat fraction (skimmed milk), in which the fat content in the high-fat fraction is determined and the fat content in the low-fat fraction is kept at a negligibly low level, the volume flow of the low-fat fraction is determined, and a specific part of the high-fat fraction is then added to the low-fat fraction for obtaining milk of the desired fat content (standardized milk), and the remaining part of the high-fat fraction (cream) is drained off through a control valve (8), which is characterized in that the part of the high-fat fraction added to the low-fat fraction is regulated by means of a control valve (12) which in conjunction with the control valve (8) for discharge of the remaining part of the high-fat fraction is controlled on the basis of the volume flow (10) of the low-fat fraction, on the basis of the volume flow (11) of the part of the high-fat fraction added to the low-fat fraction, and on the basis of the density measurement (7) of the high-fat fraction, in such a way that the density of the high-fat fraction - and thus the fat content - is maintained at a set volume. Also is described a device for carrying out the process according to the invention.